NURSERY NOTES

Forest Resources Branch
Queen's Park, Toronto, Ontario
February, 1986

No. 116

ANTITRANSPIRANTS THAT REDUCE WATER LOSS FROM BLACK SPRUCE CONTAINER SEEDLINGS

Introduction

Antitranspirants are used to reduce moisture loss in horticultural crops. Although they have been known for at least forty years (Marshall and Maki 1946) little use has been made of them on forest tree species. The potential benefit from using antitranspirants to minimize moisture loss in tree seedlings is great, but since effectiveness of these compounds can be species specific (Davies and Kozlowski 1974) it is necessary to test each of them on every species before field use.

This note reports the laboratory screening of three new antitranspirants not previously tested on black spruce container seedlings; Plantco Antidesiccant[1], Cloud Cover[2], and Dow X2-1337[3], an experimental product.

Materials and Methods

Normal production black spruce seedlings grown in Spencer Lemaire Rootrainers at the Dryden Tree Nursery from June to October, 1982 were overwintered at Dryden and transferred to the Midhurst Research Unit of the Ontario Tree Improvement and Forest Biomass Institute (OTIFBI) in April, 1983. Seedlings were grown for a second season in their containers before being shipped to OTIFBI, Maple in the fall of 1983 for overwintering. Seedlings were brought into the laboratory on April 4, 1984 in preparation for treatment. Each plug was saturated to field capacity and was placed inside a plastic bag. By sealing the plastic bag containing the plug around the base of the tree stem, only water loss due to transpiration could occur.

Plantco Anti-desiccant and Cloud Cover were applied at their recommended rates of 20% (by volume) and 33% respectively and Dow X2-1337 was applied at 7.5%, a rate found to be effective for a similar product (Davies and Kozlowski 1974). Each seedling was treated by dipping its shoot in a prepared antitranspirant solution. A water-dip served as the control treatment.

1 Plant Products Co. Ltd., 314 Orenda Rd., Bramalea, Ont. L6T 1G1
2 Adkar Inc., 1006 S. Tenth, McAllen, TX 78501
3 Dow-Corning Canada Inc., 6747 Campobella Rd., Mississauga, Ont. L5N 2M1

Following treatment, the seedlings with sealed plugs were weighed, placed in a greenhouse and left to dry for 15 days, during which time, seedling weight was periodically measured. In total, there were 4 blocks of 6 seedlings in each of 4 treatments. At the end of the drying period, the oven dry weight of each tree with its root plug was determined. The total water content of each seedling was calculated as the difference between the initial saturated seedling weight and its oven dry weight. Cumulative water loss was expressed as a percent of the initial saturated water content. Significant differences in water loss were calculated for each measurement day using a two-way analysis of variance and the L.S.D. test at the 5% level.

Results and Discussion

All three antitranspirants decreased the rate of water loss but Dow X2-1337 was the only one that maintained water loss at a consistent and relatively low rate during the entire 15 day period of the trial (Fig.1). By the end of the test period, the Dow X2-1337 treated seedlings had lost only 52% of their total moisture content while the control seedlings had lost 93%. Trees treated with Plantco Anti-desiccant and Cloud Cover lost 91% and 83% of their moisture contents respectively over the same period.

One method to compare effectiveness of antitranspirants is to determine, using a drying curve such as Figure 1, the time required for seedlings from each treatment to reach 50% water loss. Since drying depends upon a variety of environmental influences only the relative efficacies of these products should be compared. In this test, control seedlings lost 50% of their moisture after approximately 3.5 days of drying and Dow X2-1337 treated seedlings took approximately 15 days to reach the same level. Seedlings treated with Plantco Anti-desiccant and Cloud Cover reached 50% moisture loss after approximately 4.5 and 6.0 days of drying respectively.

It is important to know the relative efficacies of antitranspirants when considering their potential use. In nursery transplanting, where desiccating conditions generally last only a few days, a less effective antitranspirant might be acceptable. For outplanted seedlings, a more effective antitranspirant, only allowing slow water loss, would be preferred.

Although toxicity symptoms have been observed in a previous 28 day trial when black spruce seedlings were treated with another antitranspirant, Vapor Gard, applied at its recommended rate (Odlum and Colombo 1984), no toxicity symptoms became apparent with the compounds used in this trial. However, in British Columbia, Simpson (1984) found that some antitranspirants reduced field performance in white spruce seedlings even when visual signs of toxicity were not evident. Therefore, field plantings are being monitored to determine whether negative side effects occur to nursery stock from the application of the antitranspirants tested in this trial.

Literature Cited

Davies, W.J. and T. Kozlowski. 1974. Short- and long-term effects of antitranspirants on water relations and photosynthesis of woody plants. J. Amer. Soc. Hort. Sci. 99: 297-304.

Marshall, H. and T.E. Maki. 1946. Transpiration of pine seedlings as influenced by foliage coatings. Plant Physiol. 21: 95-101.

Odlum, K.D. and S.J. Colombo. 1984. A comparison of three antitranspirants for reducing water loss in black spruce container seedlings. Ont. Min. Nat. Res., Nursery Note No. 110.

Simpson, D.G. 1984. Film-forming antitranspirants: Their effects on root growth capacity, storability, moisture stress avoidance, and field performance of containerized conifer seedlings. For. Chron. 60: 355-339.

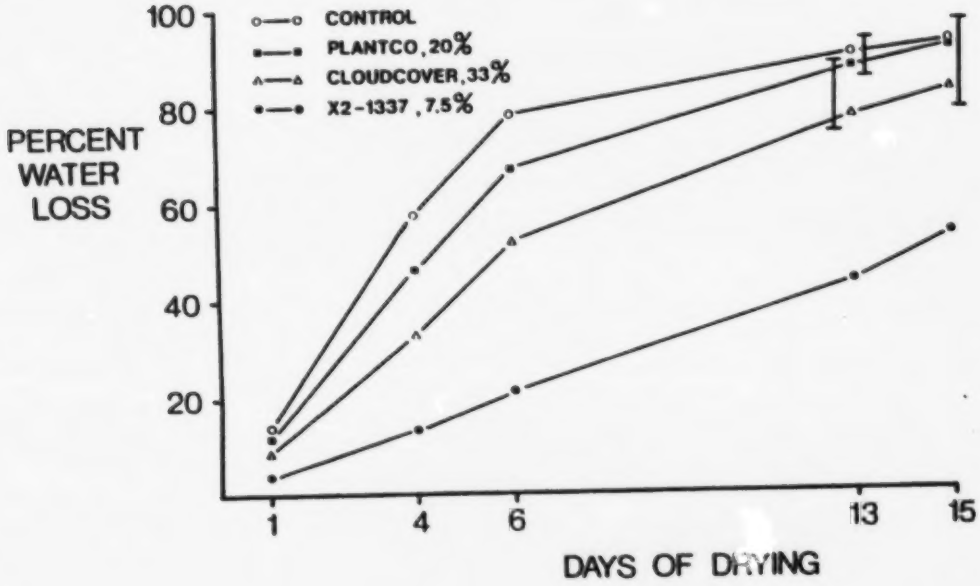

Figure 1. The relative efficacy of three antitranspirants in reducing water loss from black spruce container seedlings. Points bracketed by vertical lines do not differ significantly ($P<0.05$).

Nursery Note No. 116 was prepared by K.D. Odlum and S.J. Colombo of OTIFBI, RR#2, Maple, Ontario L0J 1E0.